

REMARKS

The present Amendment After Final Action is made in compliance with the requirements of 37 CFR §1.116. Claims 4-10 and 14-21 are cancelled without prejudice regarding their subject matter. Upon entry of the Amendment, claims 1-3 and 11-13 will be pending in the application. Applicant respectfully submits that upon entry of this Amendment the application will be in condition for allowance, as discussed in detail below. Thus, prompt and favorable consideration of this amendment is respectfully requested.

REJECTION UNDER 35 U.S.C. § 103

Claims 1-4 and 11-13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Choi et al (U.S. Pat. No. 6,499,955). This rejection is respectfully traversed.

In the instant application, the specification specifically states the following three elements are utilized to achieve surge prevention: (1) “the shape of the blade 14 must only be a function of the radius (R),” (2) “a vaneless diffuser 34 should be used in conjunction with the impeller 10,” and (3) “the length of the inducer, or height of the leading edge 26 in the axial direction (Z), should be within 5% to 7% of the outer diameter of the impeller 10.” (See paragraphs [0042]-[0044]). All three elements listed above are included in claim 1, as amended. Applicant respectfully submits that the Choi et al reference does not teach or suggest any of the above three elements, and therefore fails to teach or suggest claim 1, as amended.

Regarding element (1), amended claim 1 recites “an impeller... including: a plurality of blades... having a surface defined by an axial direction (Z), a radius (R)... and a polar angle (Θ), whereby the polar angle (Θ) is a function of only the radius (R).” In the amendment filed on November 7, 2007, Applicant noted that while the Choi et al reference discloses a generally spiral shaped blade surface in Fig. 5, the Choi et al reference is silent as to any dimensional relationship between the polar angle (Θ), the radius (R), and the axial direction (Z). In response, the Examiner asserts that the drawings of the Choi et al reference disclose an impeller having a plurality of blades in a generally spiral arrangement, and one of ordinary skill in the art would readily recognize that a spiral arrangement is defined by a polar angle that is most commonly only defined by a radial component.

However, the Choi et al reference actually teaches away from an impeller having a plurality of blades with a surface defined by an axial direction (Z), a radius (R), and a polar angle (Θ), whereby the polar angle (Θ) is a function of only the radius (R). The Choi et al reference states that Fig. 5 is a plan view of an impeller having a plurality of blades in a generally spiral arrangement. In addition, the sweeping arcuate surface of each blade is visible from this plan view. Therefore, Applicant respectfully asserts that one of ordinary skill in the art would view the Choi et al reference as teaching a spiral arrangement defined by a polar angle (Θ) that is a function of the radius (R) and the axial direction (Z). Thus, the Choi et al reference actually teaches away from an impeller having a plurality of blades with a surface defined by a polar angle (Θ) that is a function of only the radius (R).

Regarding element (2), amended claim 1 recites “a vaneless diffuser; a volute defining an open space... said vaneless diffuser including a generally open space in fluid communication with said open space of said volute.” The Choi et al reference discloses a first volute case 14 mounted to the outside of a first diffuser 12 and a second volute case 14 mounted to the outside of a second diffuser 12. (See col. 2, lines 3-8 and Fig. 1). However, the Choi et al reference is silent as to whether the first and second diffusers are vaneless. As noted in the specification of the instant application, “the diffuser commonly includes a plurality of stationary vanes which are operable to diffuse the air stream and, thus, increase the static pressure of the compressed air.” (See paragraph [0004], lines 7-9). Therefore, in the absence of language or drawings indicating otherwise, Applicant asserts that one of ordinary skill in the art would recognize the Choi et al reference as teaching a diffuser that includes a plurality of stationary vanes. In any case, the Choi et al reference does not teach or suggest a vaneless diffuser including a generally open space in fluid communication with an open space defined by a volute.

Regarding element (3), amended claim 1 recites “an inducer... said inducer... including a height component in said axial direction (Z) that is substantially five to seven percent of an outer diameter of said impeller.” In the Office Action mailed on February 14, 2007, the Examiner admits the Choi et al reference does not disclose the use of an inducer with a height between five to seven percent of the impeller outer diameter. However, in the Final Office Action mailed January 7, 2008, the Examiner asserts the Applicant has not disclosed element (3) solves any stated problem or is for any particular purpose above the fact that the inducer improves flow efficiency and it

appears the inducer disclosed in the Choi et al reference would perform equally as well as an inducer having element (3), therefore it would have been an obvious matter of design choice to modify the inducer of the Choi et al reference by utilizing element (3) for the purpose of improving the flow efficiency. However, the specification of the instant application states the three elements listed above are for the particular purpose of surge prevention.

Moreover, the specification of the instant application graphically indicates that surge can be prevented if the surge-line (A-B) is coaxially aligned with the vertical axis such that the pressure ratio is a finite when the mass flow rate is zero. (See paragraph [0040], lines 1-4 and FIG. 8). The specification of the instant application suggests the three elements listed above accomplish this relationship by ensuring that the inlet flow remains attached to the blade surface under all flow conditions, even when the inlet flow is reduced to zero. (See paragraph [0042], lines 1-3). Thus, element (3), as well as elements (1) and (2), are for the particular purpose of ensuring the inlet flow remains attached to the blade surface under all flow conditions, thereby preventing surge.

Accordingly, the Choi et al reference fails to teach or suggest all of the limitation of amended claim 1. In addition, claims 2 and 3 depend from claim 1. Therefore, reconsideration and withdrawal of the rejections of claims 1-3 are respectfully requested.

Claim 11 recites, “an impeller comprising: a plurality of blades... said blades having a surface defined by an axial direction (Z), a radius (R)... and a polar angle (Θ), whereby the polar angle (Θ) is a function of only the radius (R)... including an inducer formed proximate a leading edge of each blade, said inducer... including a height

component in said axial direction (Z) that is substantially five to seven percent of an outer diameter of said impeller.” Applicant respectfully submits that the Choi et al reference fails to teach or suggest claim 11.

As cited above, claim 11 contains elements (1) and (3) of the three elements that the specification of the instant application indicates are utilized to achieve surge prevention. Claim 11 does not contain element (2), which requires that a vaneless diffuser be used in conjunction with an impeller, as claim 11 is concerned with an impeller and therefore element (2) is beyond the scope of the claim. For the reasons stated above, the Choi et al reference fails to teach or suggest elements (1) and (3). In addition, claims 12 and 13 depend from claim 11. Therefore, reconsideration and withdrawal of the rejections of claims 11-13 are respectfully requested.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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